Contents

Preface vii

Committees and sponsors ix

Quantum Hall effect – even fractions

Theories for $\nu = 1/2$ in single- and double-layer systems
B.I. Halperin 1

New collective quantum Hall states in double quantum wells
G.S. Boebinger, S.Q. Murphy, J.P. Eisenstein, L.N. Pfeiffer, K.W. West and S. He 8

One-component to two-component transitions of fractional quantum Hall states in a wide quantum well
Y.W. Suen, H.C. Manoharan, X. Ying, M.B. Santos and M. Shayegan 13

Experimental evidence for composite particles in the fractional quantum Hall effect
R.R. Du, D.C. Tsui, H.L. Stormer, L.N. Pfeiffer and K.W. West 18

Fractional quantum Hall effect and Wigner lattice – optical studies

Occurrence of a bulk-like electron phase in the cyclotron resonance of GaAs inversion channels in the extreme quantum limit
C.M. Engelhardt, E. Gornik, M. Besson, G. Böhm and G. Weimann 23

Cyclotron resonance to 100 mK of a GaAs heterojunction in the ultra-quantum limit
J.G. Michels, S. Hill, R.J. Warburton, G.M. Summers, P. Gee, J. Singleton, R.J. Nicholas, C.T. Foxon and J.J. Harris 33

Time-resolved magneto-photoluminescence measurements of the integer QHE, fractional QHE and extreme quantum limit
S.A. Brown, A.G. Davies, A.C. Lindsay, R.B. Dunford, R.G. Clark, P.E. Simmonds, H.H. Voss, J.J. Harris and C.T. Foxon 42

Time-resolved photoluminescence in the fractional quantum Hall regime
D. Heiman, A. Pinczuk, M. Dahl, B.S. Dennis, L.N. Pfeiffer and K.W. West 50

Time-resolved magnetoluminescence and Raman scattering measured in the regime of the fractional quantum Hall effect and of the Wigner solid
I.V. Kukushkin, R.J. Haug, K. von Klitzing, K. Eberl and K. Ploog 55

Quasi-particle recombination and spatial ordering of 2D electrons in the extreme quantum limit
I.N. Harris, H.D.M. Davies, R.A. Ford, J.F. Ryan, A.J. Turberfield, C.T. Foxon and J.J. Harris 61

Photoluminescence and the Wigner crystal: can you see it?
H.A. Fertig, D.Z. Liu and S. Das Sarma 67

Numerical studies of the photoluminescence spectrum of quantum Hall systems
X.M. Chen and J.J. Quinn 71

Fractional quantum Hall effect and Wigner lattice – DC and dynamical conductivity studies

Surface acoustic wave studies of electron correlations in the 2DES
R.L. Willett 76

Ultrasonic approach to the integer and fractional quantum Hall effect
A. Esslinger, R.W. Winkler, C. Rocke, A. Wixforth, J.P. Kotthaus, H. Nickel, W. Schlapp and R. Lösch 83

Phonon measurements of the energy gap in the fractional quantum Hall state
R.H. Eyles, C.J. Mellor, A.J. Kent, K.A. Benedict, L.J. Challis, S. Kravchenko, N.N. Zinov'ev and M. Henini 87

Thermoelectric properties of $GaAs/Ga_{1-x}Al_xAs$ heterojunctions in the fractional quantum Hall regime
U. Zeitler, R. Fletcher, J.C. Maan, C.T. Foxon, J.J. Harris and P. Wyder 91

Wigner solid in two-dimensional electron system in silicon in the extreme quantum limit?
V.T. Dolgopolov, G.V. Kravchenko, S.V. Kravchenko and A.A. Shashkin 96

High temperature perturbation study of two-dimensional interacting electrons in a partly-filled Landau level
L. Zheng and A.H. MacDonald 101

Quantum Hall effect – phase diagram

Termination of the quantized Hall effect by the electron solid
V.M. Pudalov, M. D'Iorio and J.W. Campbell 107

Collective insulating state at zero magnetic field in a dilute 2D electron system
M. D'Iorio, V.M. Pudalov, S.V. Kravchenko and J.W. Campbell 115

Magnetic-field-induced transition from an Anderson insulator to a quantum Hall conductor
H.W. Jiang, I. Glozman, C.E. Johnson and S.T. Hannahs 120

Observation of finite-frequency scaling in the integer quantum Hall effect
L.W. Engel, D. Shahar, Ç. Kurdak and D.C. Tsui 124

Quantum Hall liquid–Wigner solid phase boundary
R. Price, P.M. Platzman, S. He and X. Zhu 126

Integer quantum Hall effect and edge channels

Transport properties between quantum Hall plateaus
D.B. Chklovskii and P.A. Lee 133

Direct determination of the density of states in two-dimensional systems by magnetocapacitances of biased double barrier structures
A. Song, H. Zheng, F. Yang and Y. Li 139

Transitions between edge and bulk channels in the quantum Hall regime
C.A. Richter, R.G. Wheeler and R.N. Sacks 145

Conductivity peaks in the quantum Hall regime: broadening with temperature, current, and frequency
D.G. Polyakov and B.I. Shklovskii 151

"Intrinsic" quantum Hall effect in $InAs/Ga_{1-x}In_xSb$ crossed gap heterostructures in high magnetic fields
K.S.H. Dalton, M. van der Burgt, M. Lakrimi, R.J. Warburton, M.S. Daly, W. Lubczyński, R.W. Martin, D.M. Symons, D.J. Barnes, N. Miura, R.J. Nicholas, N.J. Mason and P.J. Walker 156

Magnetic field dependence of the device-width-dependent breakdown current in the quantum Hall effect
S. Kawaji, K. Hirakawa, M. Nagata, T. Okamoto, T. Fukase and T. Goto 161

Effects of electron–electron interactions on the ground state of quantum Hall edge states
B.Y. Gelfand, J. Dempsey and B.I. Halperin 166

Total suppression of the inter-edge-channel scattering in a GaAs/AlGaAs heterostructure
R.J.F. van Haren, F.A.P. Blom, W. de Lange and J.H. Wolter 172

Junctions between coplanar 2D gases: a probe of boundary effects in the quantized Hall regime
B.E. Kane, L.N. Pfeiffer and K.W. West 176

Organic conductors

Magnetic ordering and Fermi surface effects in the low-dimensional organic conductor α-(BEDT-TTF)$_2$RbHg(SCN)$_4$
S.J. Klepper, J.S. Brooks, G.J. Athas, X. Chen, M. Tokumoto, N. Kinoshita and Y. Tanaka 181

The influence of magnetic order in quasi-2D organic conductors
M. Doporto, J. Caulfield, S. Hill, J. Singleton, F.L. Pratt, M. Kurmoo, P.J.T. Hendriks, J.A.A.J. Perenboom, W. Hayes and P. Day 187

Heterostructures, quantum wells and superlattices – energy states and optical properties

Electronic excitations in parabolically confined electron systems
A. Wixforth 194

Transition from 2D to 3D collective response: surface sensitivity
E.L. Yuh and E.G. Gwinn 202

Resonant inelastic light scattering in remotely doped wide parabolic GaAs/Al_xGa_{1-x}As quantum wells in a magnetic field
J.H. Burnett, H.M. Cheong, R.M. Westervelt, W. Paul, P.F. Hopkins, M. Sundaram and A.C. Gossard 208

Spectroscopy of quasi-2D D^- ions in the presence of excess electrons
W.J. Li, J.L. Wang, B.D. McCombe, J.-P. Cheng and W. Schaff 215

Transition energies of D^- centers in a superlattice
J.M. Shi, F.M. Peeters and J.T. Devreese 220

Negatively charged excitons X^- in the electron gas in CdTe/$Cd_{1-x}Zn_xTe$ quantum wells
K. Kheng, R.T. Cox, Y. Merle d'Aubigné, M. Mamor, N. Magnea, H. Mariette, K. Saminadayar and S. Tatarenko 225

Exciton-capture mechanism at impurities in GaAs/$Al_xGa_{(1-x)}$As quantum wells
C.I. Harris, B. Monemar, P.O. Holtz, H. Kalt, M. Sundaram, J.L. Merz and A.C. Gossard 230

Time-resolved four wave mixing studies of a two-dimensional electron gas in a magnetic field
S. Bar-Ad, I. Bar-Joseph, Y. Levinson and H. Shtrikman 234

Femtosecond studies of excitonic optical non-linearities in GaAs/Al_xGa_{1-x}As multiple quantum wells under in-plane uniaxial strain
M. Wraback, H. Shen, J. Pamulapati, M. Dutta, P.G. Newman, M. Taysing-Lara and Y. Lu 238

Terahertz electromagnetic transients as probes of a two-dimensional electron gas
W.J. Walecki, D. Some, V.G. Kozlov and A.V. Nurmikko 243

Raman scattering on modulation-doped quantum wells: intrinsic spin splitting of the GaAs conduction band
B. Jusserand, D. Richards, H. Peric and B. Etienne 247

Optical measurements of warped valence bands in quantum wells
J.A. Kash, M. Zachau, M.A. Tischler and U. Ekenberg 251

Exciton spin dynamics and polarized luminescence in quantum wells
M.Z. Maialle and L.J. Sham 256

Hole spin relaxation in a n-doped quantum well structure
Ph. Roussignol, R. Ferreira, C. Delalande, G. Bastard, A. Vinattieri, J. Martinez-Pastor, L. Carraresi, M. Colocci, J.F. Palmier and B. Etienne 263

Plasmons localized at point charges in semiconductor quantum wells
S. Rudin and T.L. Reinecke 267

Spin-resolved cyclotron resonance in a 2D electron gas
M.J. Yang, R.J. Wagner, P.J. Lin-Chung, B.V. Shanabrook, J.R. Waterman, W.J. Moore and J.L. Davis 271

Cyclotron effective mass of holes in strained $Si_{1-x}Ge_x$/Si quantum well structures
J.-P. Cheng, V.P. Kesan, D.A. Grützmacher and T.O. Sedgwick 275

Far infrared emission from magnetically quantised 2DEGs in GaAs/(AlGa)As heretojunctions
N.N. Zinov'ev, R. Fletcher, L.J. Challis, B. Sujak-Cyrul, A.V. Akimov and A.F. Jezierski 280

Reflectivity, transport and magneto-optical studies of holes in the p-type HgZnTe/CdTe superlattice
J.B. Choi, J.R. Meyer, C.A. Hoffman, G. Karczewski, J.K. Furdyna, K.H. Yoo and J.P. Faurie 285

Crossing of cyclotron and spin resonances in a 2D electron gas
V.I. Fal'ko 290

Multicomponent envelope function problems: the ultimate concept
R. Winkler and U. Rössler 295

Heterostructures, quantum wells and superlattices – transport

2DEG in strained Si/SiGe heterostructures
F.F. Fang 301

Valence band Landau level mixing and anisotropy in $Si_{1-x}Ge_x$ investigated by resonant magnetotunneling
A. Zaslavsky, D.A. Grützmacher, S.Y. Lin, T.P. Smith III and T.O. Sedgwick 307

Effect of electronic-state modulation on mobility in quantum wells
T. Tsuchiya and T. Ando 312

Wave function modification via controlled potential perturbation
K. Ensslin, H. Baum, P.F. Hopkins and A.C. Gossard 317

Non-uniform resonant coupling effect on 2D electron transport in δ-doped double quantum well structures
Y. Ohno, M. Tsuchiya, T. Matsusue, T. Noda and H. Sakaki 322

Disappearance of magnetophonon resonance at high magnetic fields in GaAs/GaAlAs heterojunctions
D.R. Leadley, R.J. Nicholas, J. Singleton, W. Xu, F.M. Peeters, J.T. Devreese, L. van Bockstal, F. Herlach, J.A.A.J. Perenboom, J.J. Harris and C.T. Foxon 327

Current induced "spin" separation in p-doped asymmetric double quantum wells
G. Goldoni and A. Fasolino 333

Quantum transport in $InAs_{1-x}Sb_x$/InSb strained layer superlattices
T. Le, A.G. Norman, W.T. Yuen, L. Hart, I.T. Ferguson, J.J. Harris, C.C. Phillips and R.A. Stradling 337

Crossover from a two- to three-dimensional electronic structure in Si spike doped GaAs superlattices
A.B. Henriques and L.C.D. Gonçalves 343

Transverse magnetic focusing and the dispersion of GaAs 2D holes at (311)A heterojunctions
J.J. Heremans, M.B. Santos and M. Shayegan 348

Resonant tunneling in quasi-2D systems

Intrinsic bistability in the electroluminescence spectrum and current–voltage characteristics of triple-barrier p–i–n resonant tunneling devices
P.A. Harrison, L. Eaves, P.M. Martin, M. Henini, P.D. Buckle, M.S. Skolnick, D.M. Whittaker and G. Hill 353

Excitonic correction to resonant tunneling
G.E.W. Bauer 358

Electron confinement in variable-area resonant tunnelling diodes using in-plane implanted gates
C.J. Goodings, H. Mizuta, J.R.A. Cleaver and H. Ahmed 363

Electron transport via resonantly coupled energy levels in triple barrier structure investigated by magnetotunneling spectroscopy
H. Kurata and H. Sakaki 369

Optical spectroscopy of inverted electron populations in double-barrier resonant-tunnelling structures
J.W. Cockburn, R.J. Teissier, M.S. Skolnick, P.D. Buckle, D.M. Whittaker, A.R.K. Willcox, G.W. Smith, G. Hill and M.A. Pate 375

Resonant inter-Landau-level tunneling of electrons and holes in superlattices
W. Müller, H.T. Grahn, K. von Klitzing and K. Ploog 380

Superlattice transport in intense terahertz electric fields
B.J. Keay, P.S.S. Guimaraes, J.P. Kaminski, S.J. Allen, Jr., P.F. Hopkins, A.C. Gossard, L.T. Florez and J.P. Harbison 385

Terahertz response of resonant tunneling diodes
J.S. Scott, J.P. Kaminski, S.J. Allen, D.H. Chow, M. Lui and T.Y. Liu 389

Electron interactions in coupled quasi-2D layers

Tunneling between highly correlated 2D electron systems
J.P. Eisenstein, L.N. Pfeiffer and K.W. West 393

One-electron Green's function and electron tunneling in a two-dimensional electron system in a strong magnetic field
S. He, P.M. Platzman and B.I. Halperin 398

Coupled electron–hole transport: generalized random-phase approximation and density functional theory
H.C. Tso, P. Vasilopoulos and F.M. Peeters 400

Observation of an abrupt double-to-single-layer transition in a double-quantum-well structure
Y. Katayama, D.C. Tsui, H.C. Manoharan and M. Shayegan 405

Effects of lateral potentials on quasi-2D electrons

Magnetotransport in antidot arrays
D. Weiss, K. Richter, E. Vasiliadou and G. Lütjering 408

Scattering of ballistic electrons by magnetic flux tubes
A.K. Geim, S.J. Bending and I.V. Grigorieva 419

Resistivity and Hall resistance of a two-dimensional electron gas in the presence of magnetic flux tubes
L. Brey and H.A. Fertig 424

Electronic states and collective excitations of a two-dimensional electron gas in spatially modulated magnetic fields
X. Wu and S.E. Ulloa 428

Two-dimensional tunneling through magnetic barriers
A. Matulis, F.M. Peeters and P. Vasilopoulos 434

Influence of a periodic potential on the integer quantum Hall effect
B. Huckestein and R.N. Bhatt 438

Negative magnetoresistance and anomalous diffusion of two-dimensional electrons in a disordered array of antidots
G.M. Gusev, P. Basmaji, Z.D. Kvon, L.V. Litvin, Yu.V. Nastaushev and A.I. Toropov 443

Contacts and ballistic transport

Anti-collimation of ballistic electrons by a potential barrier
P.T. Coleridge, R.P. Taylor, A.S. Sachrajda and J.A. Adams 448

Charge oscillations in edge states and double-frequency Aharonov–Bohm effects around a tunable obstacle
P.J. Simpson, C.J.B. Ford, D.R. Mace, I. Zailer, M. Yosefin, M. Pepper, J.T. Nicholls, D.A. Ritchie, J.E.F. Frost, M.P. Grimshaw and G.A.C. Jones 453

Control of ballistic electrons in (AlGa)As/GaAs heterostructures by means of superconducting niobium gate structures
T. Schäpers, F. Müller, A. Förster, B. Lengeler and H. Lüth 460

Metal/2DEG contact – a microscopic model
Y.B. Levinson 465

Superconductors coupled with a two-dimensional electron gas in GaAs/AlGaAs and InAs/AlGaSb heterostructures
J.R. Gao, J.P. Heida, B.J. van Wees, T.M. Klapwijk, G. Borghs and C.T. Foxon 470

Influence of gate voltage on the transport properties of superconductor/2DEG systems
K.-M.H. Lenssen, L.A. Westerling, C.J.P.M. Harmans, J.E. Mooij, M.R. Leys, W. van der Vleuten and J.H. Wolter 476

Fluctuations and chaos in low-dimensional systems

Conductance fluctuations in a quantum dot in the tunneling regime: crossover from aperiodic to regular behavior
C.M. Marcus, R.M. Westervelt, P.F. Hopkins and A.C. Gossard 480

Universal fluctuation effects in chaotic quantum dots
A.D. Stone and H. Bruus 490

Weak localization and conductance fluctuations in a chaotic quantum dot
M.J. Berry, J.A. Katine, C.M. Marcus, R.M. Westervelt and A.C. Gossard 495

Magnetotransport in a chaotic scattering cavity with tunable electron density
M.W. Keller, O. Millo, A. Mittal, D.E. Prober and R.N. Sacks 501

Conductance fluctuations of 2D electrons in a strong magnetic field
D.E. Khmelnitskii and M. Yosefin 507

Tunneling into classically chaotic orbits in quantum wells
T.M. Fromhold, M.L. Leadbeater, L. Eaves, T.J. Foster, P.C. Main and F.W. Sheard 511

Low-temperature equilibrium vertical transport through a two-dimensional electron gas
P.C. van Son, F.P. Milliken, E.E. Mendez and W.I. Wang 516

Few electron effects and charging in quantum dots

Coulomb blockade in the presence of adiabatically transmitted edge channels
B.W. Alphenaar, A.A.M. Staring, H. van Houten and C.T. Foxon 520

Electron–electron interactions and the magntoconductance of submicron quantum dots
A. Sachrajda, R.P. Taylor, C. Dharma-wardana, J.A. Adams, P. Zawadzki and P.T. Coleridge 527

Coulomb blockade of Andreev reflection in the NSN single-electron transistor
T.M. Eiles, M.H. Devoret and J.M. Martinis 536

Correlation effects on transport through few-electrons systems
J.J. Palacios, L. Martin-Moreno and C. Tejedor 541

Charging effects in small-area modulation-doped double-barrier heterostructures
S. Tarucha, T. Honda, T. Saku and Y. Tokura 547

A non-evasive voltage probe to measure Coulomb charging
C.G. Smith, M. Field, M. Pepper, D.A. Ritchie, J.E.F. Frost, G.A.C. Jones and D.G. Hasko 553

Energy levels of an artificial atom probed with single-electron capacitance spectroscopy
R.C. Ashoori, H.L. Stormer, J.S. Weiner, L.N. Pfeiffer, K.W. Baldwin and K.W. West 558

Evidence for spin singlet–triplet transitions of two electrons in a quantum dot observed via single-electron tunneling
B. Su, V.J. Goldman and J.E. Cunningham 566

Coulomb oscillation amplitude enhancement and envelope modulation in a magnetic field and activated tunneling
M. Stopa, Y. Aoyagi and T. Sugano 571

Optical studies of quantum wires and dots

Magneto-optics of quantum wires grown on V-grooved substrates
A.S. Plaut, K. Kash, E. Kapon, D.M. Hwang and E. Colas 576

Fermi-edge singularities in InGaAs and GaAs quantum wires
M. Fritze, A.V. Nurmikko and P. Hawrylak 580

Photoluminescence intensity and multiple phonon Raman scattering in quantum dots: evidence of the bottleneck effect
P.D. Wang, C.M. Sotomayor Torres, H. McLelland, S. Thoms, M. Holland and C.R. Stanley 585

Information on the confinement potential in GaAs/AlGaAs wires from magnetoluminescence experiments
F. Hirler, R. Strenz, R. Küchler, G. Abstreiter, G. Böhm and G. Weimann 591

Magneto-optics of interacting electrons in quantum dots
P. Hawrylak 597

Magnetoplasmons and FIR response of an antidot array
G.Y. Wu and Y. Zhao 601

FIR spectroscopy of the intra-Landau level excitations of strongly correlated quantum dots
X.C. Xie, S. Das Sarma and S. He 606

Quantum dots in tilted magnetic fields
B. Meurer, D. Heitmann and K. Ploog 610

Transport studies of quantum wires and dots

The influence of reduced dimensionality on the spin-splitting in GaAlAs/GaAs quantum wires
J. Wróbel, F. Kuchar, K. Ismail, K.Y. Lee, H. Nickel, W. Schlapp, G. Grabecki and T. Dietl 615

Determination of the quantum wire potential and hot electron spectroscopy using point contacts
G. Fasol, Y. Nagamune, J. Motohisa and H. Sakaki 620

Resonant tunnelling between edge states in mesoscopic wires
A.K. Geim, P.C. Main, C.V. Brown, R. Taboryski, H. Carmona, T.J. Foster, P.E. Lindelof and L. Eaves 624

Gate tuned transition to the insulating phase of one-dimensional electrons in high magnetic fields
S.W. Hwang, D.C. Tsui and M. Shayegan 629

Observation of 1D electron states at the boundary between an MOS and a Schottky contact on Si(100) by electron tunneling
U. Kunze, T. Drebinger, B. Klehn and J. Lindolf 633

Magnetophonon resonances in quantum wires
G. Berthold, J. Smoliner, E. Gornik, G. Böhm, G. Weimann, T. Suski, P. Wisniewski, C. Hamaguchi, N. Mori and H. Momose 637

Anharmonic periodic modulation in lateral surface superlattices
R. Cuscó, M.C. Holland, J.H. Davies, I.A. Larkin, E. Skuras, A.R. Long and S.P. Beaumont 643

Fabrication and characterisation of multi-level lateral nano-devices
R.P. Taylor, Y. Feng, A.S. Sachrajda, J.A. Adams, M. Davies, P.T. Coleridge and P. Zawadski 648

Magnetotransport study of GaAs/AlGaAs quantum wires
R.G. Mani, K. von Klitzing, E. Vasiliadou, P. Grambow and K. Ploog 654

Transport properties of dual quantum dots
K. Ogawa, R.J. Blaikie, J.D. White, J. Allam and H. Ahmed 659

Lateral transport through a single quantum dot with a magnetic field parallel to the current
J. Weis, R.J. Haug, K. von Klitzing and K. Ploog 664

Aharonov–Bohm conductance oscillation of an antidot
Y. Takagaki and D.K. Ferry 669

Electrons on liquid helium

The AC Hall effect for electrons on liquid helium in ultra-high magnetic fields
P.J.M. Peters, P. Scheuzger, M.J. Lea, W.P.N.M. Jacobs and R.W. van der Heijden 674

Author index 678

Subject index 694